

IN THE CLAIMS:

Please cancel Claim 3, without prejudice or disclaimer of subject matter, and please amend Claims 1, 2, and 4 - 20, as indicated below. The following is a complete listing of claims and replaces all prior versions and listings of claims in the present application:

Claim 1 (currently amended): An image pickup device ~~having~~ comprising:

sensing elements arranged in a matrix[[,];

a digital counter; and

an A/D converter provided for each column of said sensing elements, ~~characterized in that~~

wherein [[said]] each A/D converter first retains in [[its]] a memory unit as an initial value an electric signal corresponding to a signal of [[said]] a corresponding sensing element, which is an analog signal, and said A/D converter then initiates charge or discharge of said memory unit at a rate corresponding to ~~the size~~ a magnitude of an input fixed signal, measures a time period from either [[the]] a charge start time or [[the]] a discharge start time until [[the]] said electric signal of said memory unit becomes equal to [[the]] a reference signal, and recognizes [[the]] said measured time period as a digital value,

wherein each A/D converter includes an integrator, a comparator, and a digital memory,

wherein an output of said integrator is connected to an input of said comparator, an output of said comparator is connected to a loading trigger terminal of said digital memory, and

wherein said digital counter is connected to an input terminal of said digital memory, and output from said digital counter is stored in said digital memory is the digital value.

Claim 2 (currently amended): The image pickup device according to claim 1, ~~characterized in that said A/D converter comprises an integrator, and~~ wherein said initial value is determined by integrating for a certain period of time said signal of said corresponding sensing element's signal element with said integrator, and ~~[[the]] a~~ determined ~~[[said]]~~ initial value is either charged or discharged using said integrator.

Claim 3 (cancelled).

Claim 4 (currently amended): The image pickup device according to claim ~~[[3]] 1,~~ ~~characterized in that~~ wherein said integrator ~~comprises~~ includes an operational amplifier, a resistor ~~to be~~ connected to ~~one of the~~ an input ~~terminals~~ terminal of said operational amplifier, and a capacitor ~~to be~~ connected between ~~the one of the~~ said input ~~terminals~~ terminal and an output terminal of said operational amplifier.

Claim 5 (currently amended): The image pickup device according to claim ~~[[3]] 1,~~ ~~characterized in that~~ wherein said integrator ~~comprises~~ includes an operational amplifier~~[[,]]~~ and a switched capacitor circuit, which is connected to ~~one of the~~ an input ~~terminals~~ terminal of said operational amplifier.

Claim 6 (currently amended): The image pickup device according to claim 2, ~~characterized in that~~ wherein said memory unit is an output portion of said integrator.

Claim 7 (currently amended): The image pickup device according to claim 1, ~~characterized in that said~~ wherein sensing elements arranged in a column direction are selectively connected to a vertical output line, and said vertical output line and ~~[[said]]~~ a corresponding A/D converter are connected via a voltage amplifier.

Claim 8 (currently amended): The image pickup device according to claim 1, ~~characterized in that said~~ wherein

sensing elements arranged in a column direction are selectively connected to a vertical output line, ~~[[and]]~~

said vertical output line and ~~[[said]]~~ a corresponding A/D converter ~~[[is]]~~ are connected via a noise reduction circuit, and

said noise reduction circuit has a function to reduce ~~[[the]]~~ a noise signal of said signal from said sensing element ~~from the signal~~ after sensing.

Claim 9 (currently amended): The image pickup device according to claim 1, ~~characterized in that the~~ wherein reading of a row is commenced prior to ~~[[the]]~~ conclusion of ~~the output~~ outputting of a signal of another row after sensing from ~~[[the]]~~ an A/D converter.

Claim 10 (currently amended) ~~An image pickup system comprising an~~ image pickup device according to claim 1, wherein said image pickup device is incorporated in an image pickup system that includes an optical system, which focuses light to said image pickup device, and a signal processing circuit, which processes an output signal from said image pickup device.

Claim 11 (currently amended): An image pickup device ~~having~~ comprising:

sensing elements arranged in a matrix[[],];

a digital counter; and

an A/D converter provided for each column of said sensing elements, ~~characterized in that said~~

wherein each A/D converter includes a memory unit, retains in [[its]] said memory unit as an initial value an electric signal corresponding to [[the]] a signal of [[said]] a corresponding sensing element, which is an analog signal, initiates charge or discharge of said memory unit by a subsequently input first fixed signal, measures a time period from [[the]] a start of said charge or said discharge until [[when]] said electric signal of said memory unit becomes equal to a reference signal, initiates charge or discharge of said memory unit by a subsequently input second fixed signal, measures a time period for an electric signal exceeding said reference signal of said memory unit after measurement becomes equal to said reference signal, and recognizes the measured time period as a digital signal,

wherein each A/D converter includes an integrator, a comparator, and a digital memory,

wherein an output of said integrator is connected to an input of said comparator, an output of said comparator is connected to a loading trigger terminal of said digital memory, and

wherein said digital counter is connected to an input terminal of said digital memory and output from said digital counter is stored in said digital memory as the digital value.

Claim 12 (currently amended): The image pickup device according to claim 11, ~~characterized in that~~ wherein said first fixed signal [[and]] is same as said second fixed signal ~~are the same~~.

Claim 13 (currently amended): The image pickup device according to claim 1, ~~characterized in that the~~ wherein a process of either re-charging or re-discharging in order to ensure that an electric signal exceeding said reference signal reaches said reference signal is repeated more than twice.

Claim 14 (currently amended): The image pickup device ~~according to~~ according to claim 1, ~~characterized in that the~~ wherein a process of either re-charging or re-discharging, in order to ensure that an electric signal exceeding said reference signal reaches said reference signal, is conducted through ~~[[the]]~~ a synchronous operation of two or more A/D converters provided for each column of said sensing ~~element~~ elements.

Claim 15 (currently amended): The image pickup device according to claim 11, ~~characterized in that said~~ wherein sensing elements arranged in a column direction are selectively connected to a vertical output line, and said vertical output line and ~~[[said]]~~ a corresponding A/D converter are connected via at least a voltage amplifier.

Claim 16 (currently amended): The image pickup device according to claim 11, ~~characterized in that said~~ wherein

sensing elements arranged in a column direction is selectively connected to a vertical output line, ~~[[and]]~~

at least a noise reduction circuit is connected between said vertical output line and ~~[[said]]~~ a corresponding A/D converter, and

said noise reduction circuit has a function to reduce ~~[[the]]~~ a noise signal of said signal from said sensing element ~~from the signal~~ after sensing.

Claim 17 (currently amended): The image pickup device according to claim 11, ~~characterized in that the~~ wherein a differential voltage of ~~[[the]]~~ said electric signal exceeding said reference signal and said reference signal is amplified by an ~~amplifying means~~ amplifier prior to being charged or discharged.

Claim 18 (currently amended): The image pickup device according to claim 17, ~~characterized in that the~~ wherein said differential voltage of ~~[[the]]~~ said electric signal exceeding said reference signal and said reference signal ~~[[is]]~~ are retained in ~~[[the]]~~ a first terminal, and said amplifying means voltage-amplifies said differential voltage retained in said first terminal via ~~[[the]]~~ said amplifier after sample holding, and overwrites ~~[[the]]~~ said differential voltage subsequent to said voltage amplification onto said first terminal.

Claim 19 (currently amended): The image pickup device according to claim 11, ~~characterized in that the~~ reading of a row is commenced prior to ~~[[the]]~~ conclusion of ~~the output~~ outputting of a signal of another row of a digital data output operation after ~~[[the]]~~ A/D conversion.

Claim 20 (currently amended): An ~~image pickup system comprising an~~ image pickup device according to claim 11, wherein said image pickup device is incorporated in an image pickup system that includes an optical system, which focuses light to said image pickup device, and a signal processing circuit, which processes an output signal from said image pickup device.